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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/718,070	11/20/2003	Hendrik F. Hamann	YOR920030368US1 (8728-643)	8659
46069	7590	05/30/2006	EXAMINER	
F. CHAU & ASSOCIATES, LLC 130 WOODBURY ROAD WOODBURY, NY 11797			GEORGE, PATRICIA ANN	
			ART UNIT	PAPER NUMBER

1765

DATE MAILED: 05/30/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

<b>Office Action Summary</b>	<b>Application No.</b> 10/718,070	<b>Applicant(s)</b> HAMANN ET AL.	
	<b>Examiner</b> Patricia A. George	<b>Art Unit</b> 1765	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 15 March 2006.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-13, 22 and 23 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-13, and 22-23 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                                   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

***Response to Amendment***

The amendment filed on 3/15/06 is not sufficient to overcome the references provided in the Office Action, filed 12/16/05. Claims 14-21 and 24-25 have been canceled. Claims 1, 6, and 22 have been amended.

***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1, 2, 4, 5, 7, 11, 12, 13, 22, and 23 rejected under 35 U.S.C. 102(e) as being anticipated by Chen of US 6,927,410.

Chen disclosed all the limitations of claim 1: a multi-bit phase changing memory device (ab.), including: layers of phase change material (ab.) separated by layers of conductive interface (ab.), produced with varying degrees of resistivity (col.2, l.27).

As for claim 2, Chen disclosed the plurality of conductive layers (col.4, l.38-49) including a first outer conductive layer disposed at one side of the memory cell (fig.3, 26), and a second outer conductive layer disposed at a side opposite to the one side of the memory cell (fig.3, 28). Chen's figure 6, illustrates setting the electrical resistance of each of the plurality of phase change material layers in an increasing manner,

sequentially, from layer 1 through later 5, pointing to a direction from the first outer conductive layer to the second outer conductive layer.

As for claim 4, Chen's figures 4A-G illustrate wherein each of the plurality of phase change material layers have a different phase transition temperature, also concealed in column 5, lines 23-26.

As for claim 5, Chen explains a method for operating a phase change memory having a volume of memory material, including a plurality of discrete layers of materials. The method includes applying heat to the volume of material for a predetermined amount of time (col.3, l.28-43), which demonstrates the following limitation claimed: each of the plurality of phase change material layers has the same phase transition temperature.

As for claim 7, in figure 3 (explained in col.4, l. 27-49), Chen illustrates a plurality of conductive layers (fig. 3, 26/24/28), including a plurality of intermediate layers (fig.3, 24), disposed between the first (fig.3, 26) and second (fig. 3, 28) outer conductive layers, each of the intermediate conductive layers (fig.3, 24) having the same dimensions as an adjacent phase change material layer.

As for claim 11, Chen discloses the phase change material layers are made of Ge.sub.2Sb.sub.2Te.sub.5 (col.4, l.52).

As for claim 12, Chen discloses the plurality of conductive layers are made of W, TiW, etc. (col.4, l.44).

As for claim 13, Chen demonstrates the number of phase change material layers corresponds to the number of possible bit values storable (col.4, l. 36-38).

As for claim 22, Chen expresses memory technologies can be read only, write once only, or repeatedly read/write which represents a programming circuit that writes data to the array of multi-bit phase change memory cells; and a sensing circuit that reads out data from the array of multi-bit phase change memory cells. All other limitations of claim 22 are discussed above.

As for claim 23, see discussion to claim 11.

As for the amendment to claims 1 and 22, the reference of Chen teach a multi-bit phase change memory cell (claim 1) or multi-bit phase change memory (claim 22), where each of said plurality of phase change material layers has a different height from one another, please refer to: column 1, lines 35 through column 2, lines 36, where Chen teaches phase change memory devices, such as multi-bit memory cells, i.e. multi-bit phase change memory cell (claim 1) and i.e. multi-bit phase change memory (claim 22); and see column 8, lines 28-36, where Chen teaches a plurality of phase change material layer with different thicknesses, i.e. where plurality of phase change material layers has a different height from one another. The term thickness is interpreted as a dimension between two surfaces, as opposed to length or width, i.e. used to describe the height of a semiconductor layer.

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the

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invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 3, 6, 9, and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chen of US 6,927,410 (see discussion above) in view of Klersy et al. of USPN 5,536,947.

Chen does not explicitly disclose each of the phase change material layers has a different cross-sectional surface area from one another.

However, Chen does disclose a plurality of phase change material layers with different thicknesses, see column 8, lines 28-36.

It would have been obvious to one of ordinary skill in the art at the time of invention was made, to that plurality of phase change material layers with different thicknesses, as in the reference of Chen, would also have different cross-sectional surface area from one another, because the mathematical equation for surface area is dependent on height (i.e. thickness) as a multiplier, and a variety of heights would calculate a result with a variety of surface areas.

Chen fails to demonstrate the plurality of phase change material layers are of similar resistivity (as in applicants' claim 3), have different dimensions (as in applicants' claim 6), and are made of the same or different material (as in claims 9 and 10).

Klersy et al. teaches compositional modification of phase change materials, including use of any means to modifying the compositions, such as modifying: the

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volume to yield stable values of resistance, which points to the plurality of phase change material layers having different dimensions (as in applicants' claim 6); and the phase change material layers made of the same or different material, as in claims 9 and 10 (col.14, l.3-54).

As for claim 3, Klersy et al. teaches, multiple layers of the same alloy may be present in the same volume (col.14, l.36-37), which demonstrates each of the plurality of phase change material layers could have the same resistivity.

It would have been obvious to one of ordinary skill in the art at the time of invention was made, to modify the invention of multi-bit phase changing memory device, of Chen, to include compositional modification, such as: of similar resistivity, having different dimensions, and of same or a variety of materials, as in Klersy, because Klersy teaches it is desirable to minimize drift of resistance values, a process improvement know to resolve problems with the storage of gray scale information.

### ***Claim Rejections - 35 USC § 103***

Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Chen of US 6,927,410 (see discussion above) in view of Ovshinsky et al. of US 2004/0178401.

Chen fails to teach, the limitation to structure as recited in claim 8.

Ovshinsky illustrates all the limitations of claim 8 in figure 3, and explained in Example 1: a dielectric layer (60) formed between the first outer electrode (90) and the second outer electrode (30) and along sides of at least one other conductive layer (70)

and a phase change material layer (80) disposed directly adjacent to the at least one other conductive layer (110).

It would have been obvious to one of ordinary skill in the art at the time of invention was made, to modify the invention of multi-bit phase changing memory device, of Chen, to include the structure of forming said device, as Ovshinsky, because Ovshinsky demonstrates a specific structure exhibits the ability to modulate the threshold voltage between two electrodes of a multi-terminal device by applying a control voltage to a control terminal. This modulation effect represents improved functionality because the structure includes multi-terminal devices, a process improvement to the standard two-terminal devices.

### ***Response to Arguments***

Applicant's arguments filed 3/15/2006 have been fully considered but they are not persuasive.

In response to applicants' argument, on page 6, that the reference of Chen fails to teach a multi-bit phase change memory cell (claim 1) or multi-bit phase change memory (claim 22), where each of said plurality of phase change material layers has a different height from one another, please refer to: column 1, lines 35 through column 2, lines 36, where Chen teaches phase change memory devices, such as multi-bit memory cells, i.e. multi-bit phase change memory cell (claim 1) and i.e. multi-bit phase change memory (claim 22); and see column 8, lines 28-36, where Chen teaches a plurality of phase change material layer with different thicknesses, i.e. where plurality of phase



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change material layers has a different height from one another. The term thickness is interpreted as a dimension between two surfaces, as opposed to length or width, i.e. used to describe the height of a semiconductor layer. Examiner disagrees with applicants, as Chen clearly anticipates all the features of claims 1 and 22.

In response to applicants' argument, on page 7, that the combination of reference of Chen, Klersy, and Ovshinsky fails to teach all the features recited in claims 1 and 22, please see response to arguments presented on page 6, above.

In response to applicants' argument, on page 8, that the references of Klersy, and Ovshinsky fail to cure the deficiency of the Chen patent, please see response to arguments presented on page 6, above. Furthermore the reference of Ovshinsky was provided to teach the structure as limited in claim 8, and the reference of Klersy was provided to teach material with similar resistance having different dimensions made of the same or different materials, as limited in claims 3, 6, 9, and 10.

### ***Conclusion***

**THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any

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extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure: US 6,087,674; US 6,864,503; US 6,893,912; US 2003/0145257; US 2005/0112896.


Any inquiry concerning this communication or earlier communications from the examiner should be directed to Patricia (Patty) George whose telephone number is (571) 272-5955. The examiner can normally be reached on weekdays between 7:00am and 4:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on (571) 272-1465. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

  
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Patricia A George  
Examiner  
Art Unit 1765

  
SHAMIM AHMED  
PRIMARY EXAMINER